REMARKS

Changes to the Drawings

Proposed drawing corrections to Figures 1A-1B, with proposed changes made in red, have been submitted herewith to correct various informalities. Formal drawings including the proposed corrections will be provided after approval of the drawing corrections.

Rejections of Cancelled Claims

In the parent case, claims 1-3, 5-6, 9-20, 28-29, and 35 were rejected under U.S. Patent No. 5,499,238 issued to Shon (*Shon*) and U.S. Patent No. 5,381,413 issued to Tobagi et al. (*Tobagi*). These claims have been cancelled; therefore, the rejection of these claims is moot. Claims 36-38 were added in the preliminary amendment dated June 20, 2000. However, these claims have been cancelled herein.

Patentability of New Claims Over Cited References

Applicants submit that new claims 39-66 are patentable over *Shon* and *Tobagi*. New independent claims 39 and 53 contain limitations different from the limitations of the claims cancelled herein. Claims 40-52 and 54-66 depend from claims 39 and 53, and therefore, they necessarily include all the limitations of the claims from which they depend. Therefore, Applicants submit that the rejections under *Shon* and *Tobagi* do not apply to claims 39-66.

Conclusion

By this supplemental amendment, claims 1-3, 5-6, 9-20, 28-29, and 35-38 have been cancelled without prejudice. Claims 39-66 have been added. Therefore, claims 39-66 are pending. Applicants submit that claims 39-66 are in condition for allowance, and such action is

earnestly solicited. The Examiner is respectfully requested to contact the undersigned by telephone if such contact would further the examination of the present application.

Please charge any shortages and credit any overcharges to our Deposit Account number 02-2666.

Respectfully submitted,
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Date: 11/22/02

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AMENDMENTS WITH MARKINGS

IN THE SPECIFICATION

The paragraph beginning at page 20, line 4:

Figure 3 is a flow diagram illustrating periodic evaluation of QoS categories according to one embodiment of the present invention. In this embodiment, at step 310, processing loops until the predetermined evaluation time period has expired. For example, a test may be performed to determine if the current time is greater than or equal to the last evaluation time plus the predetermined evaluation time interval. Alternatively, the evaluation process may be triggered by an interrupt. In any event, when it is time to evaluate the QoS queue categorization, processing continues with step [320] 330.

IN THE CLAIMS

1. (Cancelled) A method comprising:

receiving at a packet forwarding device information indicative of one or more traffic groups;

receiving at the packet forwarding device one or more bandwidth parameters for at least one of the one or more traffic groups, the bandwidth parameters including at least a minimum bandwidth parameter indicating a minimum amount of bandwidth the at least one traffic group needs to be provided over a defined time period;

receiving at a first port of a plurality of ports a packet associated with the at least one traffic group; and

scheduling the packet for transmission from a second port of the plurality of ports based upon the one or more bandwidth parameters for the at least one traffic group with which the packet is associated.

2. (Cancelled) The method of claim 1, wherein the network employs a non-deterministic access protocol.

3. (Cancelled) The method of claim 2, wherein the non-deterministic access protocol is Carrier Sense Multiple Access with Collision Detection (CSMA/CD).

4. (Cancelled) The method of claim 1, wherein the one or more bandwidth parameters include a minimum bandwidth.

5. (Cancelled) The method of claim 1, wherein the one or more bandwidth parameters include an indication regarding a maximum sustained bandwidth the at least one traffic group can realize over a defined time period.

6. (Cancelled) The method of claim 5, wherein the one or more bandwidth parameters include an indication regarding a peak bandwidth representing a bandwidth the at least one traffic group may utilize during a particular time interval in excess of the maximum bandwidth.

7. (Cancelled) The method of claim 1, wherein the one or more bandwidth parameters include a maximum delay.

8. (Cancelled) The method of claim 1, wherein the one or more bandwidth parameters include a relative priority.

9. (Cancelled) The method of claim 1, further comprising:

classifying the packet as being associated with the at least one traffic group; and

determining a quality of service queue with which the at least one traffic group is associated.

10. (Cancelled) The method of claim 1, further comprising:

enqueuing the packet onto a queue associated with the traffic group;

determining a current bandwidth metric for the queue; and

dequeuing the packet from the queue if the current bandwidth metric meets a predetermined relationship with the one or more bandwidth parameters.

11. (Cancelled) The method of claim 10, wherein the current bandwidth metric is evaluated periodically at the expiration of a predetermined time period, and wherein the step of determining a current bandwidth metric for the queue further comprises:

determining an actual bandwidth for a prior time period;

determining a bandwidth metric for the prior time period; and

combining a portion of the actual bandwidth for the prior time period with a portion of the bandwidth metric for the prior time period to arrive at the current bandwidth metric.

12. (Cancelled) A method of bandwidth management and traffic prioritization for use in a network of devices, the method comprising:

defining at a packet forwarding device information indicative of one or more traffic groups;

defining at the packet forwarding device information indicative of a quality of service (QoS) policy for the one or more traffic groups, the QoS policy including at least a minimum bandwidth parameter indicating a minimum amount of bandwidth the one or more traffic groups need to be provided over a defined time period;

receiving a packet at a first port of a plurality of ports;

identifying a first traffic group of the one or more traffic groups with which the packet is associated; and

scheduling the packet for transmission from a second port of the plurality of ports based upon the QoS policy for the first traffic group, and wherein the scheduling is independent of end-to-end signaling.

13. (Cancelled) The method of claim 12, wherein the network of devices employs a non-deterministic access protocol.

14. (Cancelled) The method of claim 13, wherein the non-deterministic access protocol is Carrier Sense Multiple Access with Collision Detection (CSMA/CD).

15. (Cancelled) The method of claim 12, further comprising:

providing a plurality of QoS queues; and

mapping the first traffic group to a first QoS queue of the plurality of QoS queues.

16. (Cancelled) The method of claim 15, further comprising:

determining a current bandwidth metric for each of the plurality of QoS queues;

dividing the plurality of QoS queues into at least a first group and a second group based upon the current bandwidth metrics and a minimum bandwidth requirement associated with each of the plurality of QoS queues;

if the first group includes at least one QoS queue, then transmitting a packet from the at least one QoS queue; otherwise transmitting a packet from a QoS queue associated with the second group.

17. (Cancelled) A method comprising:

receiving at a packet forwarding device information indicative of one or more traffic groups;

receiving at the packet forwarding device information defining a quality of service (QoS) policy for at least one of the one or more traffic groups, the QoS policy including at least a minimum bandwidth indicating a minimum amount of bandwidth the at least one traffic group needs to be provided over a defined time period;

providing a plurality of queues at each of a plurality of output ports;

associating the one or more traffic groups with the plurality of queues based upon the minimum bandwidth; and

scheduling a packet for transmission from one of the plurality of queues onto the network.

18. (Cancelled) The method of claim 17, wherein the information indicative of the one or more traffic groups includes Internet Protocol (IP) subnet membership.

19. (Cancelled) The method of claim 18, wherein the information indicative of the one or more traffic groups includes a media access control (MAC) address.

20. (Cancelled) The method of claim 17, wherein the information indicative of the one or more traffic groups includes a virtual local area network (VLAN) identifier.

21. (Cancelled) A method of bandwidth management and traffic prioritization for use in a network of devices, the method comprising the steps of:

providing a plurality of quality of service (QoS) queues at each of a plurality of output ports, each of the plurality of QoS queues associated with a minimum queue bandwidth requirement;

adding a packet to one of the plurality of QoS queues based upon a traffic group with which the packet is associated; and

scheduling a next packet for transmission onto the network from one of the plurality of QoS queues at a particular output port of the plurality of output ports by:

determining a current bandwidth metric for each of the plurality of QoS queues,

dividing the plurality of QoS queues into at least a first group and a second group based upon the current bandwidth metrics and the minimum queue bandwidth requirements, and

if at least one QoS queue of the plurality of QoS queues, so divided, is associated with the first group, then transmitting a packet from the at least one QoS queue; otherwise transmitting a packet from a QoS queue of the plurality of QoS queues associated with the second group.

22. (Cancelled) The method of claim 21, wherein the current bandwidth for a particular QoS queue is calculated as follows:

$CURR\_BW_i = W1 \times CURR\_BW_i + W2 \times ACT\_BW_i$;

where:

$CURR\_BW_i$ represents the current bandwidth for a particular QoS queue,

W1 represents a first weighting factor,

W2 represents a second weighting factor, and

ACT_BW_i represents the actual bandwidth received by the particular QoS queue in a previous time interval.

23. (Cancelled) The method of claim 22, wherein $W1 = (W-1)/W$, $W2 = 1/W$, and the previous time interval is the most recent time interval.

24. (Cancelled) The method of claim 21, further comprising the step of selecting among QoS queues in the same group based upon relative queue priorities associated with the QoS queues.

25. (Cancelled) The method of claim 21, further comprising the step of selecting among QoS queues in the same group based upon a round robin selection scheme.

26. (Cancelled) The method of claim 21, further comprising the step of selecting among QoS queues in the same group based upon a least recently used (LRU) selection scheme.

27. (Cancelled) The method of claim 21, wherein the first group comprises QoS queues associated with a minimum queue bandwidth requirement that is less than the corresponding QoS queue's current bandwidth metric, and wherein the second group comprises QoS queues associated with a minimum queue bandwidth requirement that is greater than or equal to the corresponding QoS queue's current bandwidth metric.

28. (Cancelled) A method of bandwidth management for use in a packet forwarding device participating in a connectionless network, the method comprising:

receiving at a packet forwarding device information indicative of one or more traffic groups;

receiving at the packet forwarding device one or more bandwidth parameters for at least one of the one or more traffic groups, the bandwidth parameters including at least a minimum bandwidth indicating a minimum amount of bandwidth the at least one traffic group needs to be provided over a defined time period;

receiving at a first port of a plurality of ports a packet associated with the at least one traffic group; and

scheduling the packet for transmission from a second port of the plurality of ports based upon the one or more bandwidth parameters for the traffic group with which the packet is associated.

29. (Cancelled) A packet forwarding device for use in a network employing a non-deterministic assess protocol, the packet forwarding device comprising:

an input unit configured to receive information defining one or more traffic groups and one or more associated bandwidth parameters, the one or more associated bandwidth parameters

including minimum bandwidth indicating a minimum amount of bandwidth the traffic group needs to be provided over a defined time period;

a plurality of ports configured to transmit packets onto an attached network segment, each port having a plurality of queues and configured to select a queue of the plurality of queue from which to transmit a next packet based upon the one or more bandwidth parameters; and

a filtering and forwarding engine coupled to the plurality of ports and configured to process received packets, the filtering and forwarding engine identifying a traffic group of the one or more traffic groups with which a received packet is associated and queuing the received packet for transmission from one of the plurality of ports based upon the identified traffic group.

30. (Cancelled) A packet forwarding device for use in a network employing a non-deterministic assess protocol, the packet forwarding device comprising:

a filtering and forwarding engine configured to forward received packets based upon a traffic group with which the packet is associated; and

a plurality of ports coupled to the filtering and forwarding engine, each port of the plurality of ports configured to receive packets from the filtering and forwarding engine, each port of the plurality of ports having a plurality of Quality of Service (QoS) queues associated with a minimum queue bandwidth requirement, each port of the plurality of ports further configured to schedule a packet for transmission onto the network by

determining a current bandwidth metric for each of the plurality of QoS queues,

dividing the plurality of QoS queues into at least a first group and a second group based upon the current bandwidth metrics and the minimum queue bandwidth requirements, and

if at least one QoS queue of the plurality of QoS queues, so divided, is associated with the first group, then transmitting a packet from the at least one QoS queue; otherwise

transmitting a packet from a QoS queue of the plurality of QoS queues associated with the second group.

31. (Cancelled) The packet forwarding device of claim 30, wherein the plurality of ports are further configured to select among QoS queues in the same group based upon relative queue priorities associated with the QoS queues.

32. (Cancelled) The packet forwarding device of claim 30, wherein the plurality of ports are further configured to select among QoS queues in the same group based upon a round robin selection scheme.

33. (Cancelled) The packet forwarding device of claim 30, wherein the plurality of ports are further configured to select among QoS queues in the same group based upon a least recently used (LRU) selection scheme.

34. (Cancelled) The packet forwarding device of claim 30, wherein the first group comprises QoS queues associated with a minimum queue bandwidth requirement that is less than the corresponding QoS queue's current bandwidth metric, and wherein the second group comprises QoS queues associated with a minimum queue bandwidth requirement that is greater than or equal to the corresponding QoS queue's current bandwidth metric.

35. (Cancelled) A machine-readable medium having stored thereon data representing sequences of instructions, said sequences of instructions which, when executed by a processor, cause said processor to perform:

receiving at a packet forwarding device information indicative of one or more traffic groups;

receiving at the packet forwarding device information defining a quality of service (QoS) policy for at least one of the one or more traffic groups, the QoS policy including at least a

minimum bandwidth indicating a minimum amount of bandwidth the at least one traffic groups needs be provided over a defined time period;

receiving a packet at a first port of a plurality of ports;

identifying a first traffic group of the one or more traffic groups with which the packet is associated; and

scheduling the packet for transmission from a second port of the plurality of ports based upon the QoS policy for the first traffic group, and wherein the scheduling is independent of end-to-end signaling.

36. (Cancelled) The method of claim 1, wherein QoS profile attributes associated with each of the one or more traffic groups include a maximum delay, specifying a time period beyond which further delay cannot be tolerated for the particular traffic group.

37. (Cancelled) The method of claim 1, wherein the other QoS profile attributes associated with each of the one or more traffic groups include a Relative Priority, defining the relative importance of a particular traffic group with respect to other traffic groups.

38. (Cancelled) A method comprising:

receiving at a packet forwarding device information indicative of one or more traffic groups;

receiving at the packet forwarding device one or more bandwidth parameters for at least one of the one or more traffic groups;

receiving at a first port of a plurality of ports a packet associated with the at least one traffic group;

enqueuing the packet onto a queue associated with the at least one traffic group;

scheduling the packet for transmission from a second port of the plurality of ports based upon the one or more bandwidth parameters for the at least one traffic group with which the packet is associated by

periodically evaluating a current bandwidth metric for the queue; by

determining an actual bandwidth for a prior time period;

determining a bandwidth metric for the prior time period; and

combining a portion of the actual bandwidth for the prior time period with a portion of the bandwidth metric for the prior time period to arrive at the current bandwidth metric; and

dequeuing the packet from the queue if the current bandwidth metric meets a predetermined relationship with the one or more bandwidth parameters.

39. (New) A method for bandwidth management in a packet forwarding device, comprising:

identifying a quality of service (QoS) metric corresponding to a traffic group, the QoS metric defining a minimum QoS for the traffic group;

receiving a data packet associated with the traffic group;

placing the data packet into one of a plurality of queues;

identifying a current measure of network performance with respect to parameters specified in the QoS metric; and

removing the data packet from the queue if a difference between the current measure and the minimum QoS falls within a threshold.

40. (New) The method of claim 39 wherein identifying the QoS metric corresponding to a traffic group further comprises:

identifying the traffic group through an Internet Protocol (IP) subnet membership identifier; and

determining a corresponding QoS metric defining a minimum QoS for the traffic group.

41. (New) The method of claim 39 wherein identifying the QoS metric corresponding to a traffic group further comprises:

identifying the traffic group through a media access control (MAC) address; and

determining a corresponding QoS metric defining a minimum QoS for the traffic group.

42. (New) The method of claim 39 wherein identifying the QoS metric corresponding to a traffic group further comprises:

identifying the traffic group through a virtual local area network (VLAN) identifier; and

determining a corresponding QoS metric defining a minimum QoS for the traffic group.

43. (New) The method of claim 39 wherein identifying the QoS metric comprises receiving information indicating a minimum bandwidth for the traffic group.

44. (New) The method of claim 39 wherein identifying the QoS metric comprises receiving information indicating a maximum sustained bandwidth for the traffic group.

45. (New) The method of claim 44 wherein identifying the QoS metric comprises receiving information indicating a peak bandwidth representing a bandwidth in excess of the maximum sustained bandwidth that the traffic group can utilize.

46. (New) The method of claim 39 wherein identifying the QoS metric comprises receiving information indicating a maximum allowable delay for the traffic group.

47. (New) The method of claim 39 wherein identifying the QoS metric comprises receiving information indicating a relative priority associated with the traffic group.

48. (New) The method of claim 39 wherein determining a current measure of network performance occurs at specified intervals of time.

49. (New) The method of claim 39 wherein determining a current measure of network performance with respect to parameters specified in the QoS metric comprises calculating the current measure for the parameters specified in the QoS metric.

50. (New) The method of claim 39 wherein receiving the data packet comprises receiving the data packet on a first port of a plurality of ports, and wherein removing the data packet from the queue comprises transmitting the data packet from a second port of the plurality of ports.

51. (New) The method of claim 39 wherein the packet forwarding device employs a non-deterministic access protocol.

52. (New) The method of claim 51 wherein the non-deterministic access protocol employed by the packet forwarding device is the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol.

53. (New) An article of manufacture comprising a machine accessible medium having content that when accessed provides instructions to cause an electronic system to:

identify a quality of service (QoS) metric corresponding to a traffic group, the QoS metric defining a minimum QoS for the traffic group;

receive a data packet associated with the traffic group;

place the data packet into one of a plurality of queues;

identify a current measure of network performance with respect to parameters specified in the QoS metric; and

remove the data packet from the queue if a difference between the current measure and the minimum QoS falls within a threshold.

54. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric corresponding to a traffic group further comprises the content to provide instructions to cause the electronic system to:

identify the traffic group through an Internet Protocol (IP) subnet membership identifier; and

determine a corresponding QoS metric defining a minimum QoS for the traffic group.

55. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric corresponding to a traffic group further comprises the content to provide instructions to cause the electronic system to:

identify the traffic group through a media access control (MAC) address; and

determine a corresponding QoS metric defining a minimum QoS for the traffic group.

56. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric corresponding to a traffic group further comprises the content to provide instructions to cause the electronic system to:

identify the traffic group through a virtual local area network (VLAN) identifier; and

determine a corresponding QoS metric defining a minimum QoS for the traffic group.

57. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric comprises the content to provide instructions to cause the electronic system to receive information indicating a minimum bandwidth for the traffic group.

58. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric comprises the content to provide instructions to cause the electronic system to receive information indicating a maximum sustained bandwidth for the traffic group.

59. (New) The article of manufacture of claim 58 wherein the content to provide instructions to cause the electronic system to identify the QoS metric comprises the content to provide instructions to cause the electronic system to receive information indicating a peak bandwidth representing a bandwidth in excess of the maximum sustained bandwidth that the traffic group can utilize.

60. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric comprises the content to provide instructions to cause the electronic system to receive information indicating a maximum allowable delay for the traffic group.

61. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to identify the QoS metric comprises the content to provide instructions to cause the electronic system to receive information indicating a relative priority associated with the traffic group.

62. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to determine a current measure of network performance comprises the content to provide instructions to cause the electronic system to determine the current measure at specified intervals of time.

63. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to determine a current measure of network

performance with respect to parameters specified in the QoS metric comprises the content to provide instructions to cause the electronic system to calculate the current measure for the parameters specified in the QoS metric.

64. (New) The article of manufacture of claim 53 wherein the content to provide instructions to cause the electronic system to receive the QoS metric comprises the content to provide instructions to cause the electronic system to receive the data packet on a first port of a plurality of ports, and wherein the content to provide instructions to cause the electronic system to remove the data packet from the queue comprises the content to provide instructions to cause the electronic system to transmit the data packet from a second port of the plurality of ports.

65. (New) The article of manufacture of claim 53 wherein the packet forwarding device employs a non-deterministic access protocol.

66. (New) The article of manufacture of claim 65 wherein the non-deterministic access protocol employed by the packet forwarding device is the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol.